Network Systems Science & Advanced Computing

Biocomplexity Institute & Initiative

University of Virginia

Estimation of COVID-19 Impact in Virginia

December 8th, 2021

(data current to December 4th – 7th)

Biocomplexity Institute Technical report: TR 2021-123

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Key Takeaways

Projecting future cases precisely is impossible and unnecessary.
Even without perfect projections, we can confidently draw conclusions:

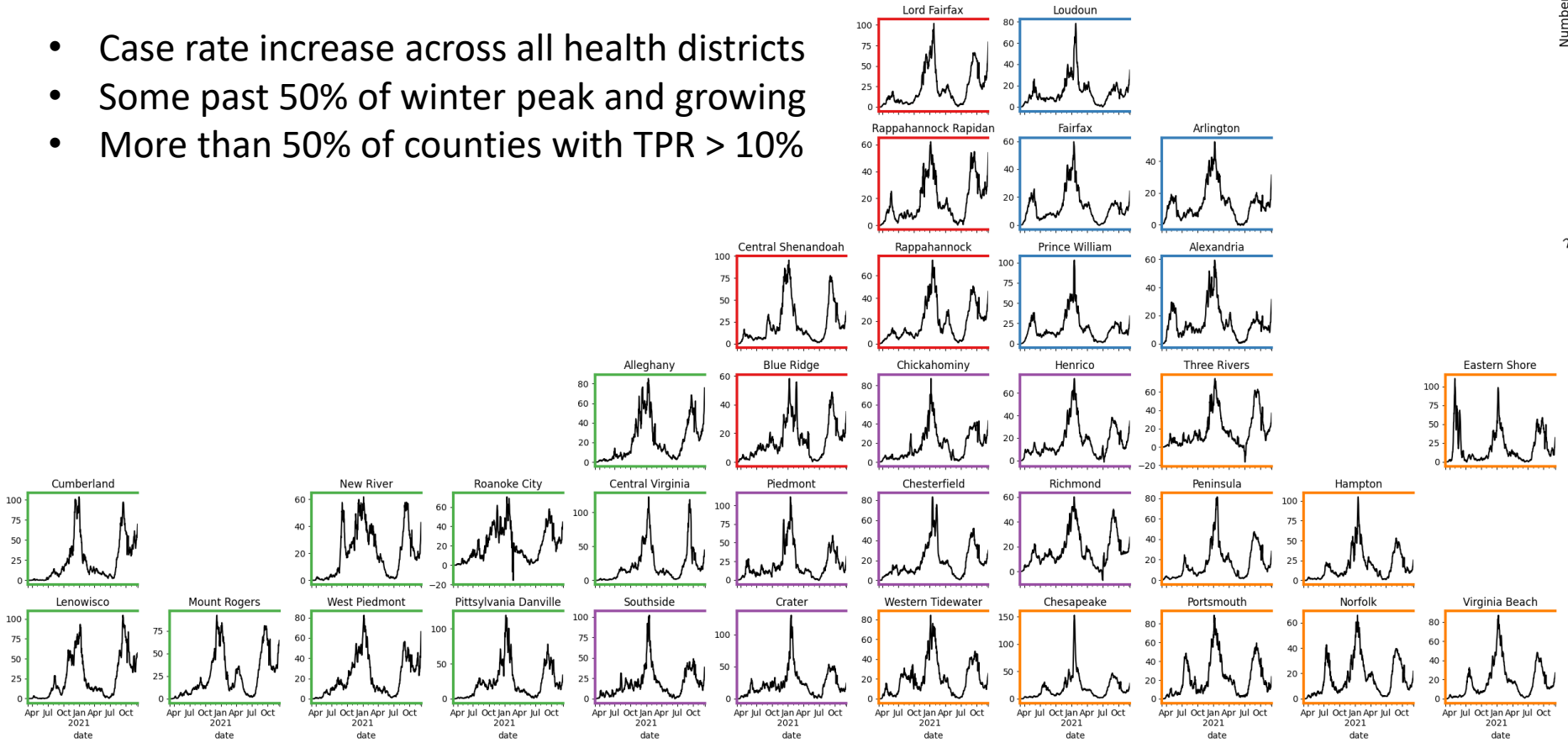
- **Case rates after holiday break decline after brief rise with a mix of activity across the commonwealth; holiday effects caused brief dips in activity last year**
- VA 7-day mean daily case rate receded to 16.7/100K from 20/100K; US is down to 25/100K (from 29/100K)
- Projections show a flattening with eventual rise should current low transmission drivers persist
- As seasonal factors mount trajectories may shift towards the FallWinter2020 scenario with more rapid near-term growth; this scenario shows considerable growth is still possible.
- Recent updates:
  - Overhauled model structure to better capture different tiers of immunity and the effects of waning
  - Analysis of the effects of increasing 3rd dose coverage

The situation continues to change. Models continue to be updated regularly.

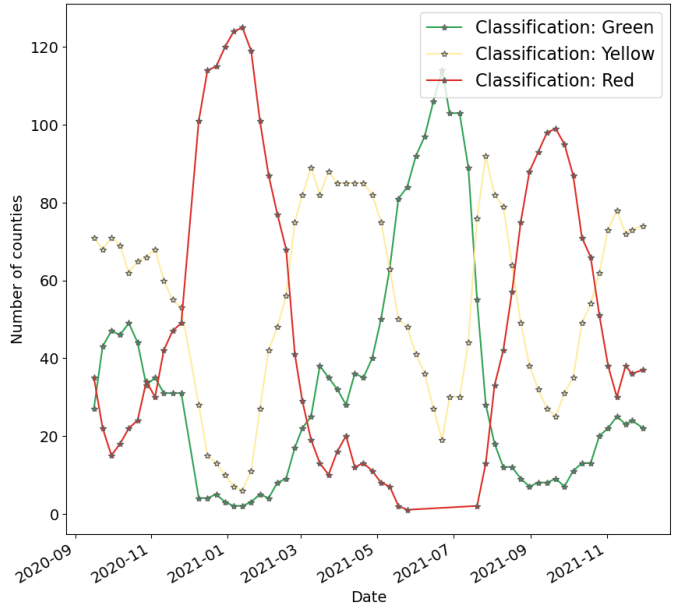
Situation Assessment

Case Rates (per 100k) and Test Positivity

- Case rate increase across all health districts
- Some past 50% of winter peak and growing
- More than 50% of counties with TPR > 10%



Data source: https://data.cms.gov/covid-19/covid-19-nursing-home-data



County level RT-PCR test positivity

Green: <5.0% (or <20 tests in past 14 days)

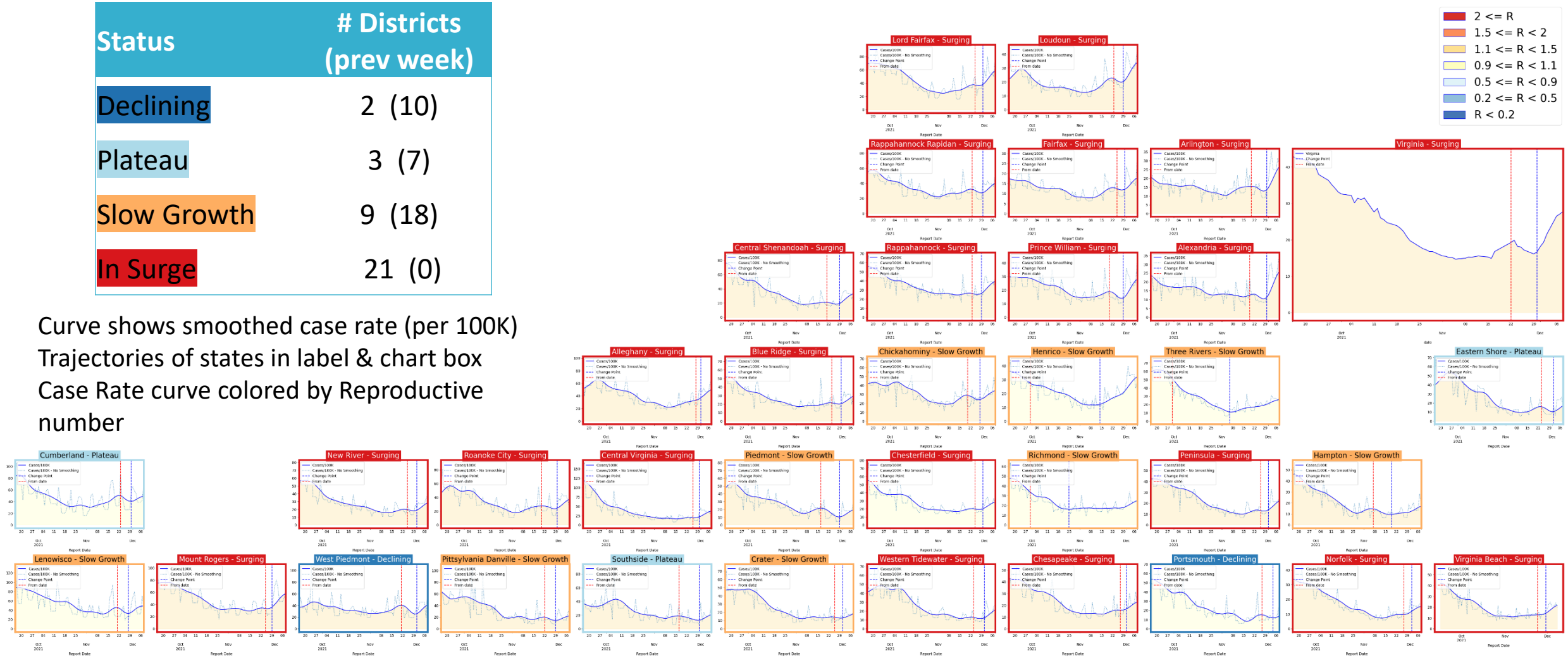
Yellow: 5.0%-10.0% (or <500 tests and <2000 tests/100k and >10% positivity over 14 days)

Red: >10.0% (and not "Green" or "Yellow")

District Trajectories – last 10 weeks

Status	# Districts (prev week)
Declining	2 (10)
Plateau	3 (7)
Slow Growth	9 (18)
In Surge	21 (0)

Curve shows smoothed case rate (per 100K)
Trajectories of states in label & chart box
Case Rate curve colored by Reproductive number



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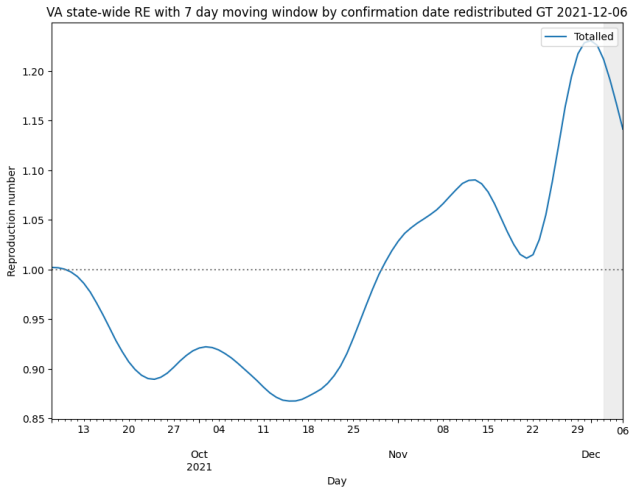
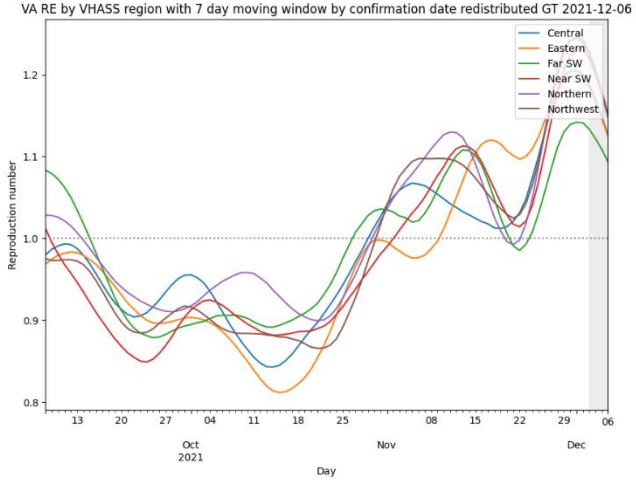
Estimating Daily Reproductive Number – Redistributed gap

Dec 8th Estimates

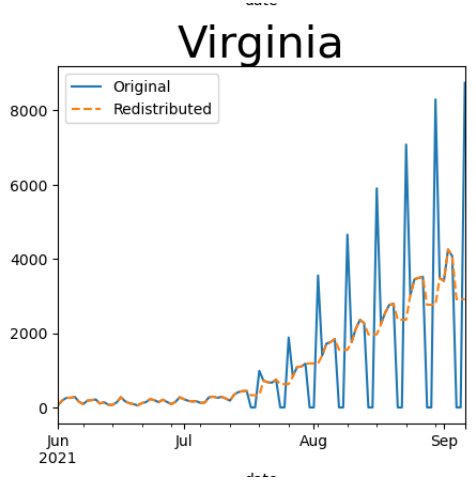
Region	Date Confirmed R_e	Date Confirmed Diff Last Week
State-wide	1.253	0.349
Central	1.107	0.182
Eastern	1.125	0.153
Far SW	1.101	0.311
Near SW	1.159	0.315
Northern	1.160	0.291
Northwest	1.132	0.233





Skipping Weekend Reports & holidays biases estimates

Redistributed "big" report day to fill in gaps, and then estimate R from "smoothed" time series



Methodology

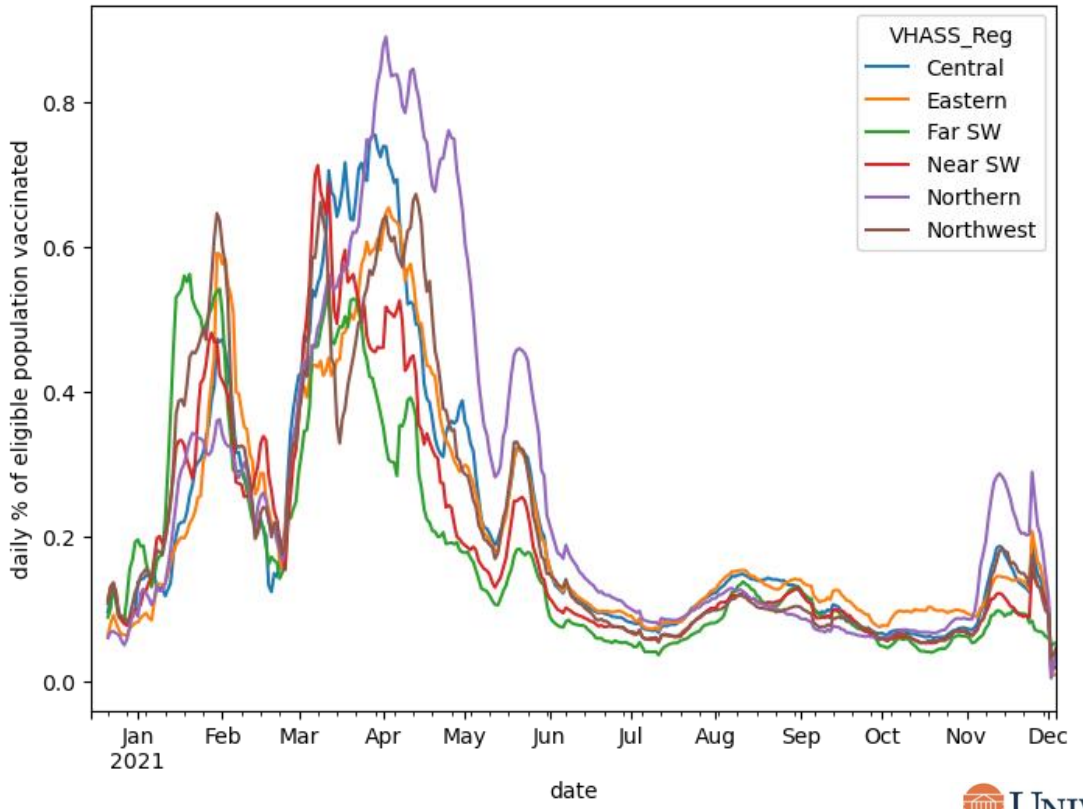
- Wallinga-Teunis method (EpiEstim[1]) for cases by **confirmation date**
- Serial interval: updated to discrete distribution from observations (mean=4.3, Flaxman et al, Nature 2020)
- Using Confirmation date since due to increasingly unstable estimates from onset date due to backfill

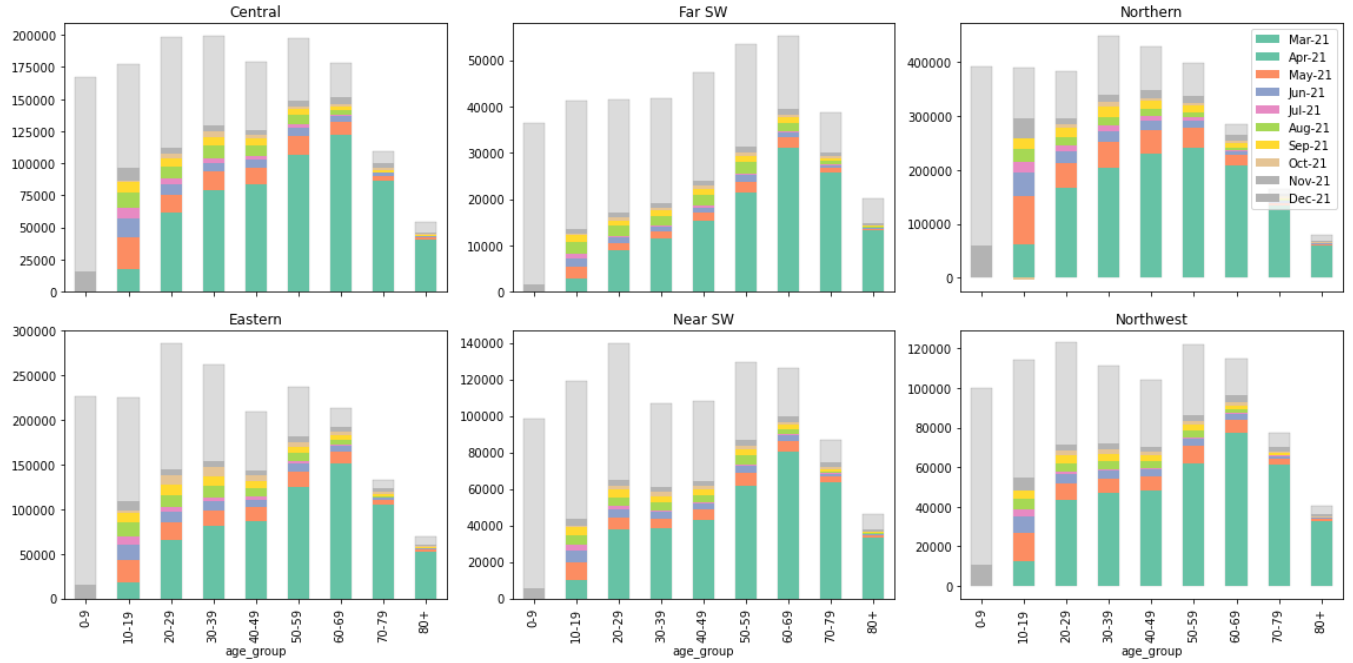
1. Anne Cori, Neil M. Ferguson, Christophe Fraser, Simon Cauchemez. A New Framework and Software to Estimate Time-Varying Reproduction Numbers During Epidemics. American Journal of Epidemiology, Volume 178, Issue 9, 1 November 2013, Pages 1505–1512, https://doi.org/10.1093/aje/kwt133

Vaccination Administration Slow

Regional Vaccine courses initiated per day (% eligible):

- Proportion eligible for first dose of vaccines across regions (in the ~0.1% or 100 per 100K a day)
- Age-specific proportions of population vaccinated show recent progress in younger ages





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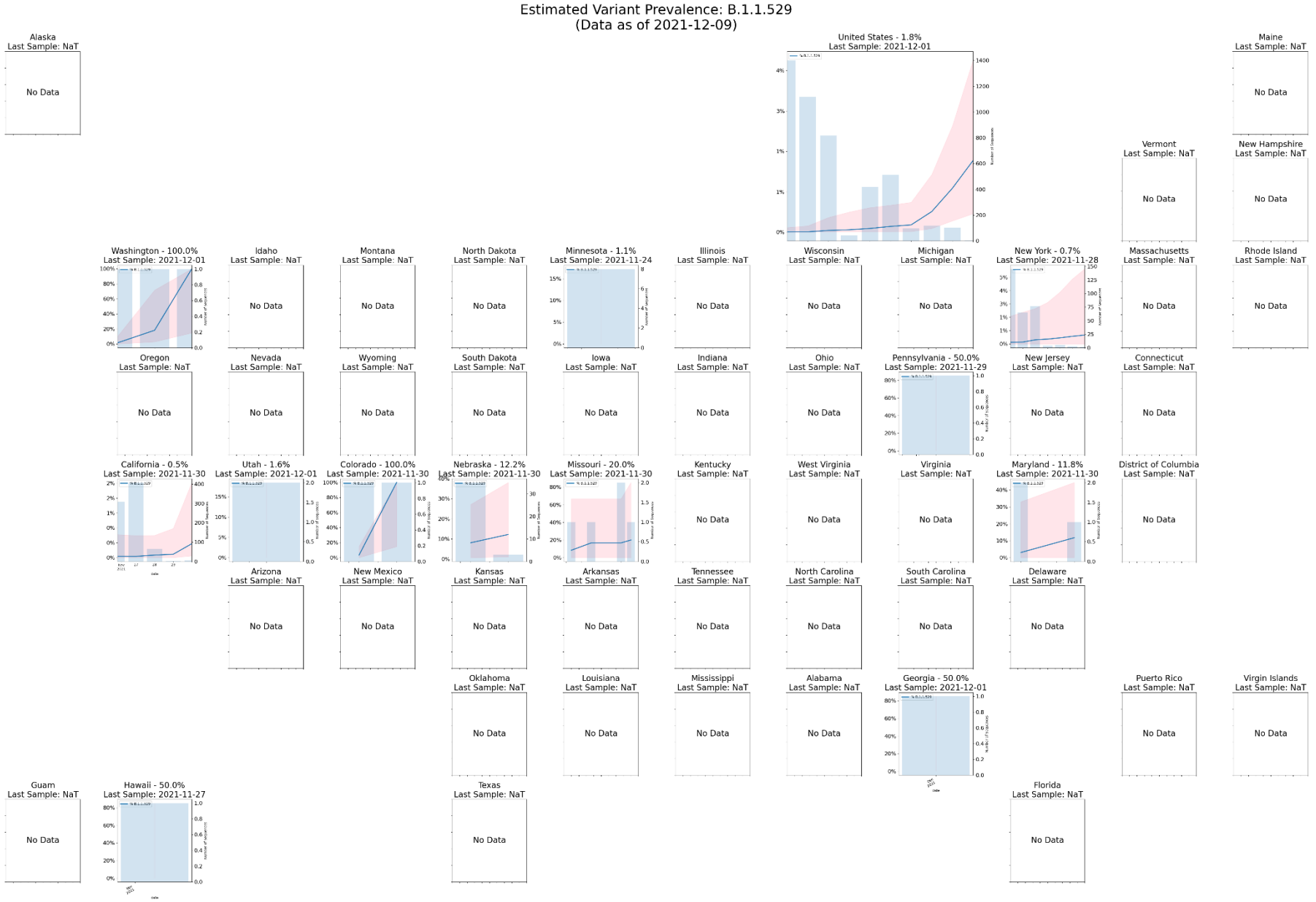
Omicron Current Publicly Available Genomes



Vaccines and Variants, Omicron

1. South Africa's case count has shown a steep increase since the detection of the Omicron variant. Details are still forthcoming on the number of breakthrough cases, Omicron prevalence, severity of infection.
2. Within RSA the recent increase in cases is centered around Gauteng which has the lowest vaccination levels in the country.
3. Omicron has a high number of mutations in the spike protein. Many associated with immune escape.
4. Among those, three of the mutations in combination have demonstrated complete neutralization escape in some sera. In this study mRNA-1273 demonstrates better neutralization than convalescent sera.
5. Previous VoC's with high immune escape ability have demonstrated lower intrinsic transmissibility. Even if this is the case immune escape ability could allow Omicron to spread more effectively.
6. The S69/70 deletion may enable detection of Omicron via PCR based on SGTF dropout on certain platforms. Mutational prevalence among circulating infections in VA currently appears low, potentially boosting precision for this early detection method.

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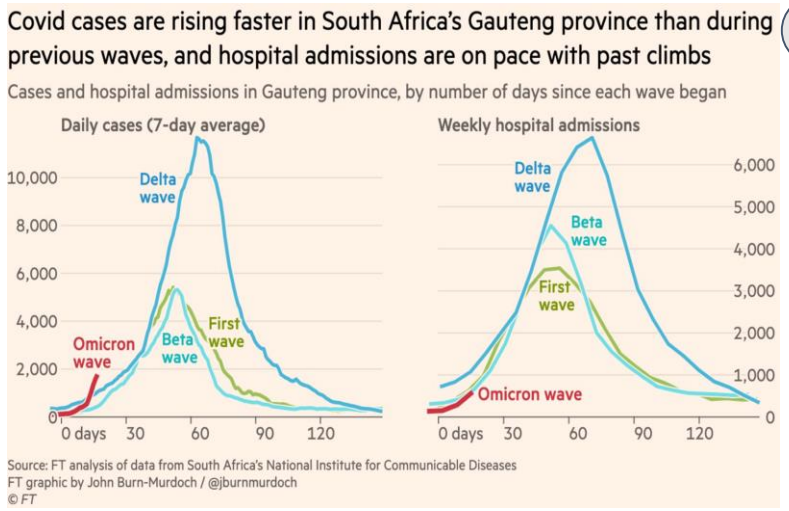

https://twitter.com/jburnmurdoch/status/1465659957546782725

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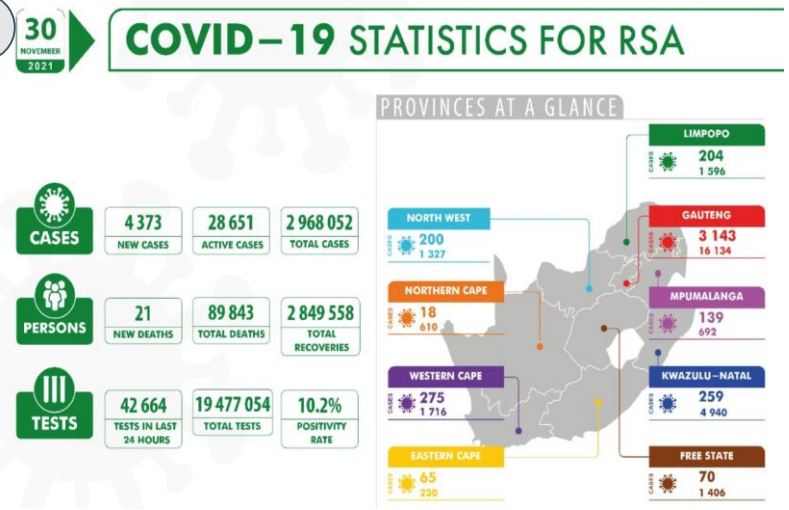

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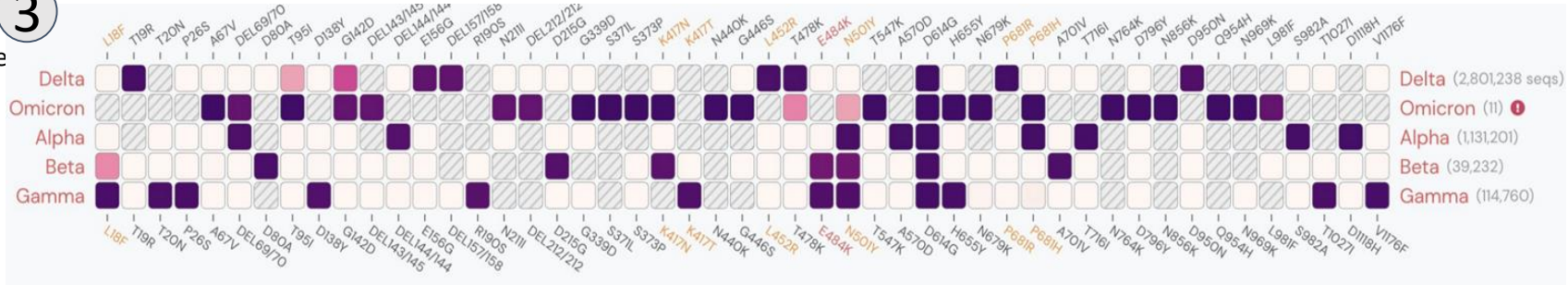

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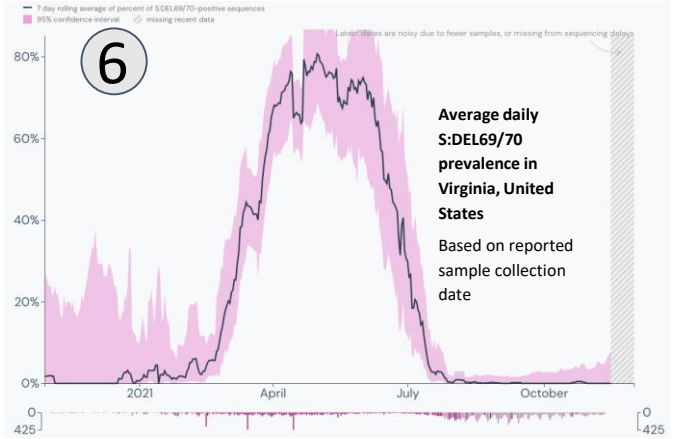

https://outbreak.info/situation-reports?muts=S%3ADEL69%2F70&loc=USA&loc=USA_US-VA&selected=USA_US-VA&overlay=false

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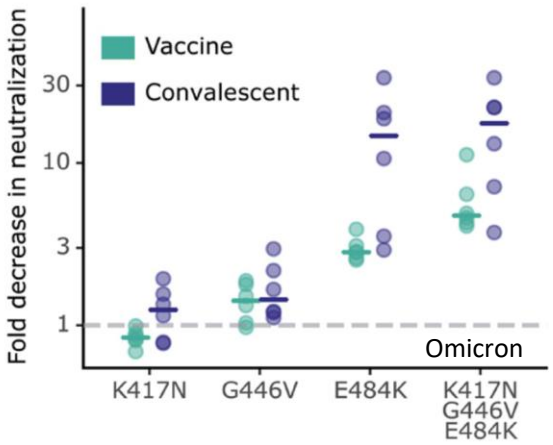

https://www.science.org/doi/10.1126/scitranslmed.abi9915#F5

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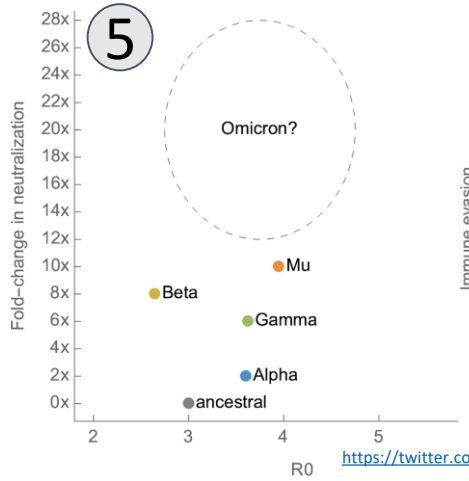
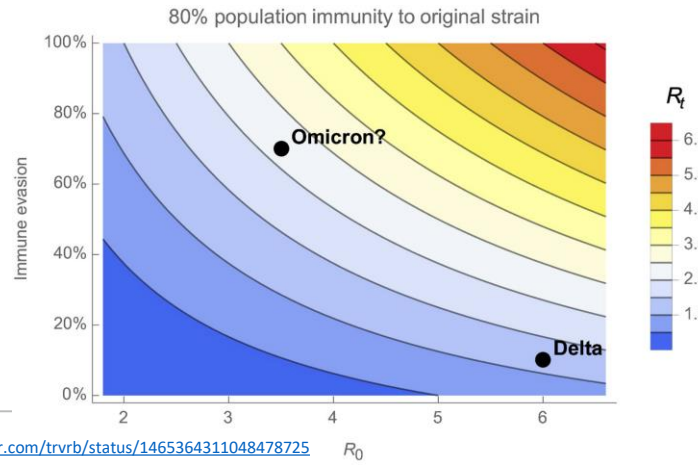




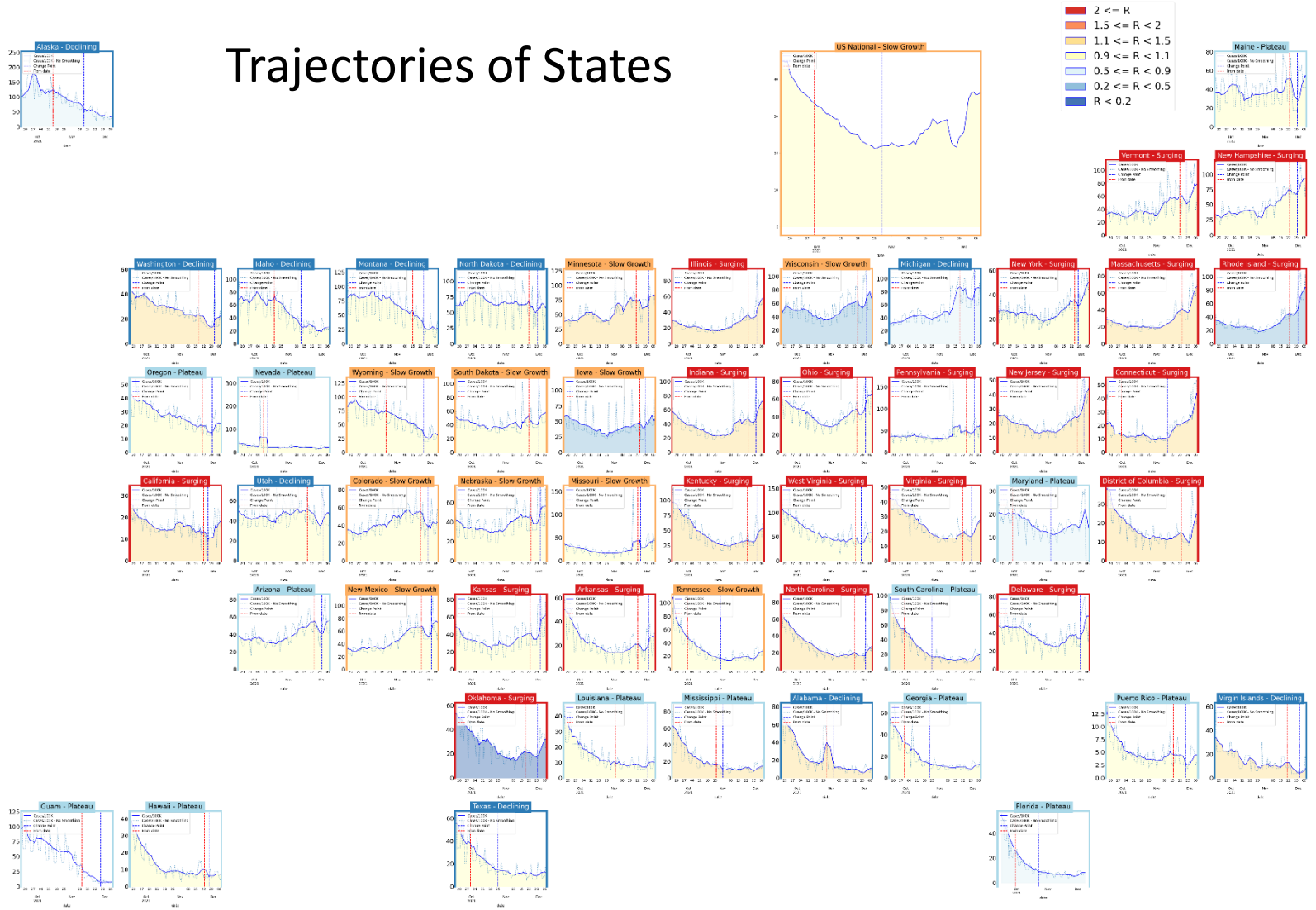
https://twitter.com/trvrb/status/1465364311048478725

United States Overall

- Near majority of states in surge
- Holiday effect still biases some trajectories
- Nationally growth may be slowing but reporting artifacts remain

Status	# States (1 weeks ago)
Declining	10 (35)
Plateau	13 (10)
Slow Growth	10 (2)
In Surge	21 (7)

Trajectories of States



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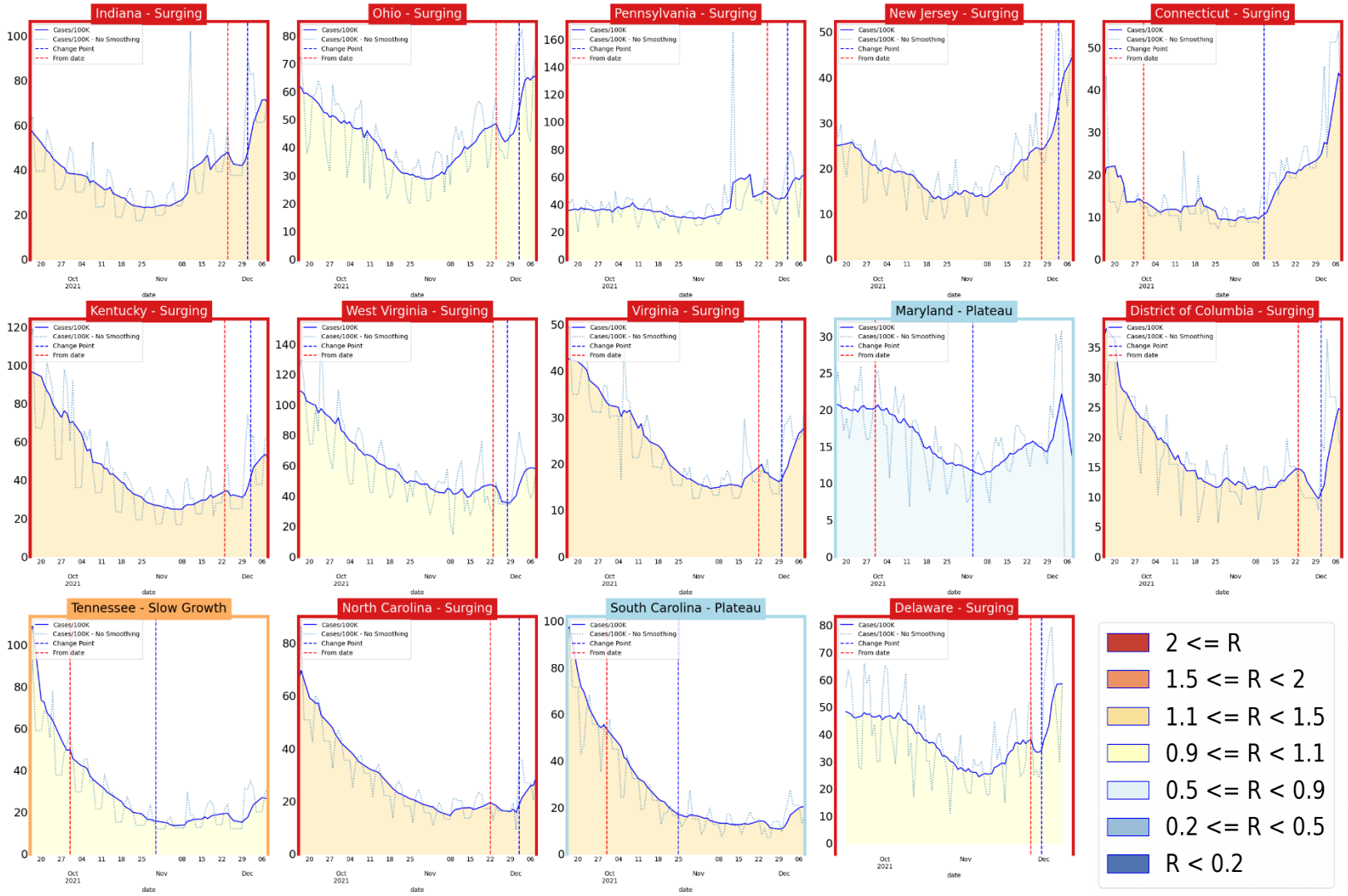
Virginia and Her Neighbors

- Neighbors now surging



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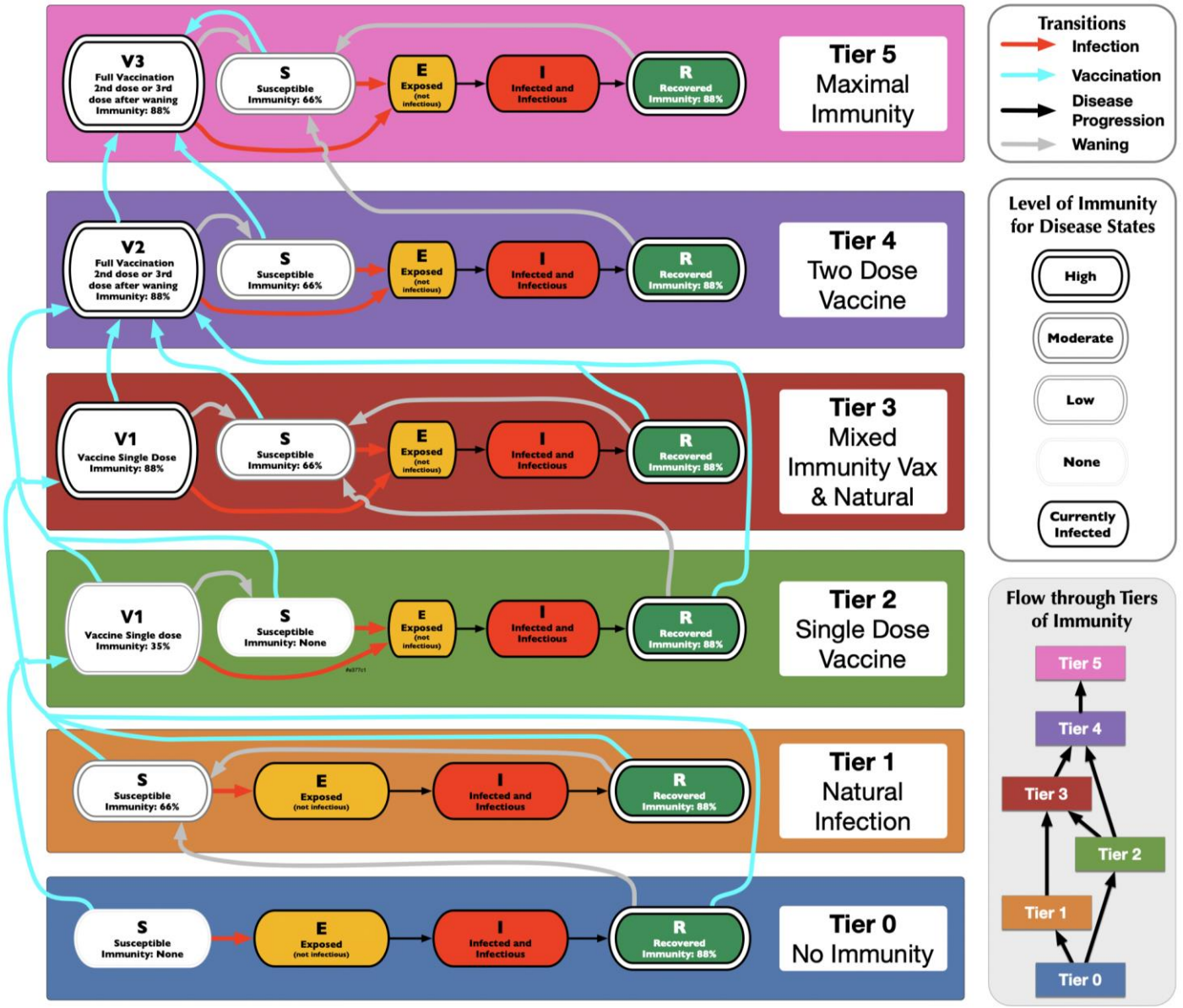
Model Update – Adaptive Fitting

New Model Structure Focused on Tiers of Immunity

Uncertainty surrounds the rate of waning immunity

- Added Tier to better capture Omicron effects.
- Outcomes vary based on age and immune history, for partial immunity protection against hospitalization and death is stronger than No Immunity but weaker than Maximal Immunity
- Use same Adaptive fitting approach with vaccine schedules and simulated infections driving movement across the tiers
- Different Scenarios can also be applied



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